

# Giovanni as a Tool for Teaching Remote Sensing Applications

2012 Gregory G. Leptoukh Giovanni Workshop

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**ARSET - AQ**

**Applied Remote SEnsing Training – Air Q**uality

A project of NASA Applied Sciences



# **NASA and Earth Science**

## ***Applied Sciences Program***

Applications to Decision Making: Eight Thematic Areas



**Agricultural  
Efficiency**



**Air Quality**



**Climate**



**Disaster  
Management**



**Ecological  
Forecasting**



**Public Health**



**Water  
Resources**



**Weather  
(Aviation)**

# Who are we training ?

- **Air Quality Managers and Regulators**  
EPA, state and local regulatory agencies, US Forest Service
- **Scientists/Technical:** Meteorologists, air quality forecasters and modelers, health scientists, AQ researchers
- **Other/public:** project managers, reps. from health agencies, World Bank

# Expertise

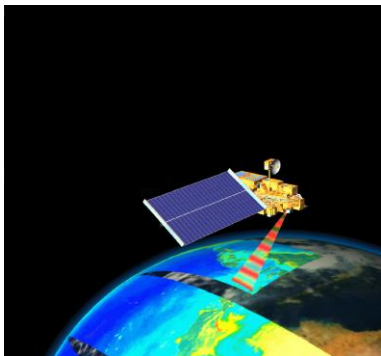
ANY Audience can span a large range in expertise:

- **No background in remote sensing** and little science background
- **No background in remote sensing and some science background**
- **Introductory expertise** with satellite data
- **Moderate expertise** with satellite data

# NASA Satellite Products for Air Quality Applications

- **Particulate Pollution** (dust, haze, smoke)
  - Qualitative: Visual imagery
  - Quantitative\*: Column Products and vertical extinction profiles
- **Fire Products:** Fire locations or 'hot spots'
- **Trace Gases**
  - Quantitative\*: Column Products
  - Vertical profiles: mostly mid-troposphere
  - Some layer products

# Giovanni Instances Used in ARSET-AQ Training



Terra and Aqua MODIS Daily

Aura OMI Level 2G

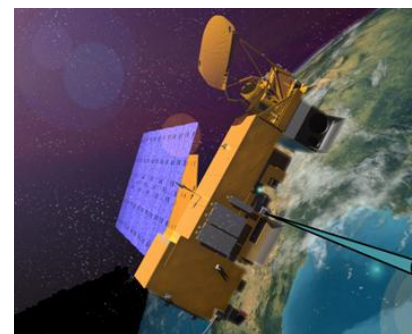
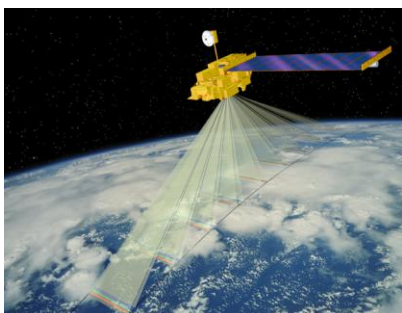
Aqua/AIRS Global Daily

Air Quality



A-Train Along CloudSat Track

MISR Daily



# **Our principal uses for Giovanni**

## **- conceptual organization**

First exposure to hands on use of satellite data.

Illustrating proper use of data

Quick access to data for exploratory analysis

Comparison of coincident data sets

# Introductory Activity

Used to:

- 1) Provide a first exposure to satellite data products.
- 1) Begin the process of educating our users about how to evaluate the quality of satellite remote sensing products and proper and improper uses of data and tools.
- 3) Illustrate the strengths and limitations of Giovanni.

The document which provides instructions on how to produce the plots used in the activity as well as the presentation used to guide the follow up discussion can be found on our website.

<http://Airquality.gsfc.nasa.gov/Tool>

The activity is called “Giovanni Beginning Exploration”

# Evaluating Remote Sensing Data

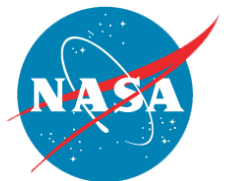
Or

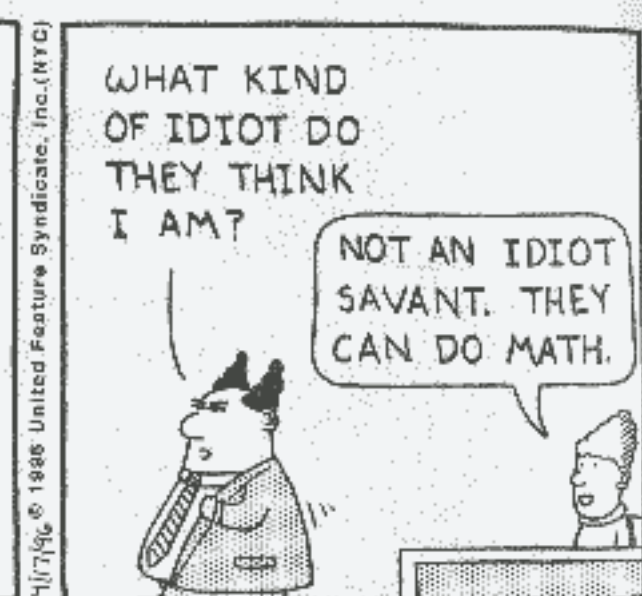
How to Avoid  
Making Great Discoveries by Misinterpreting Data

Richard Kleidman

**ARSET-AQ**

**Applied Remote Sensing Education  
and Training**



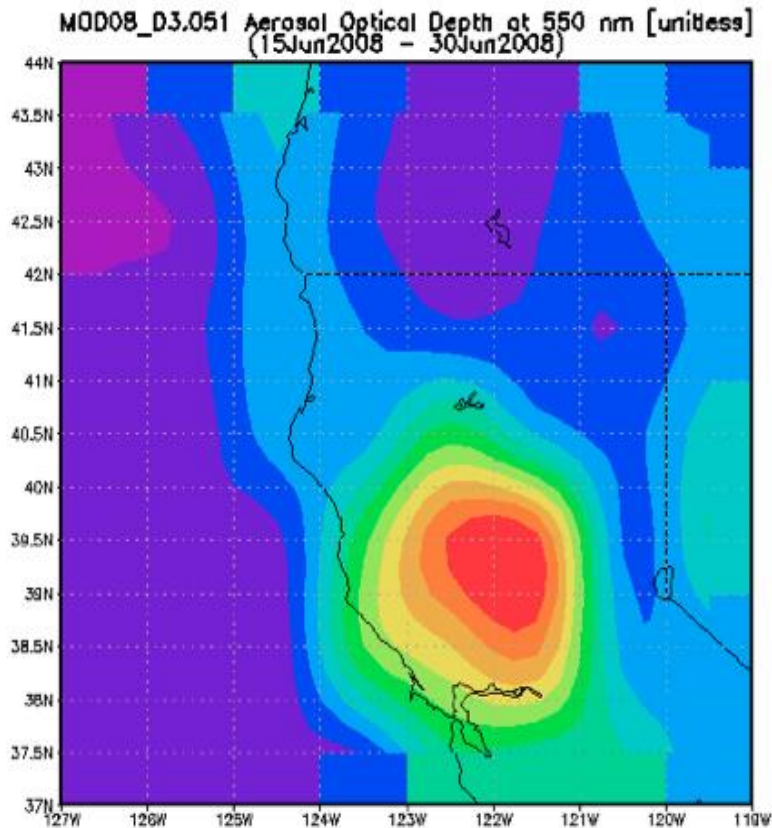


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# AOD at 550 nm Area Average Plot

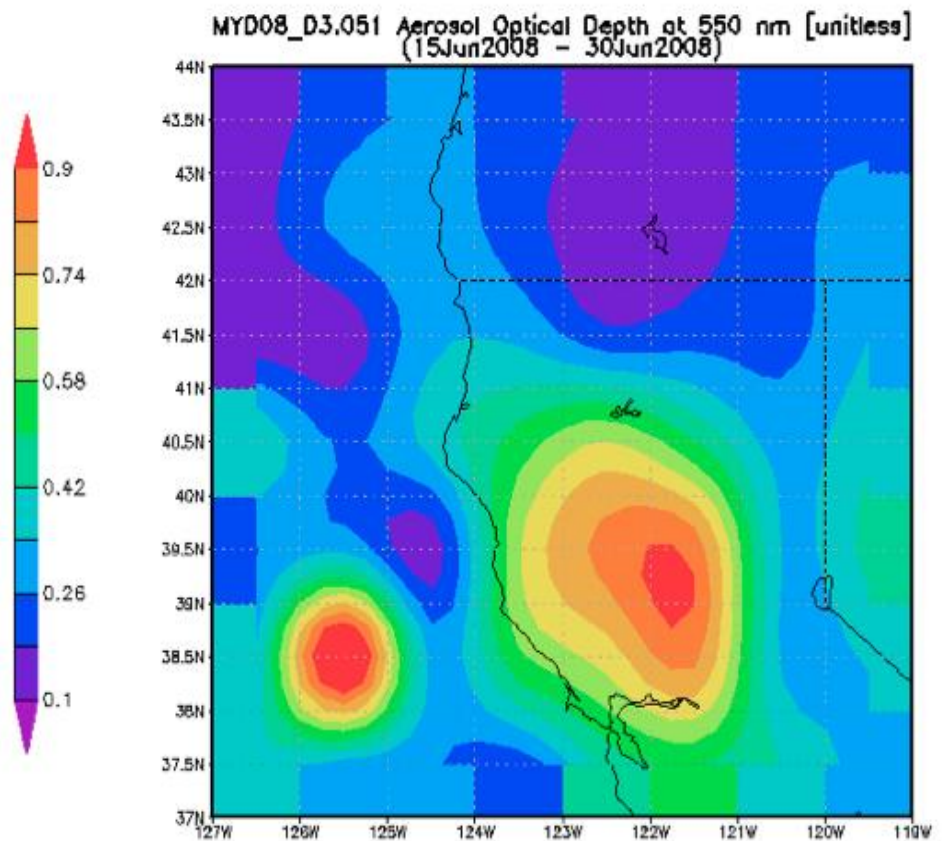
## Giovanni MODIS Daily Instance

### June 15 - 30, 2008



Terra

Daily Overpass ~ 10:30 AM local time



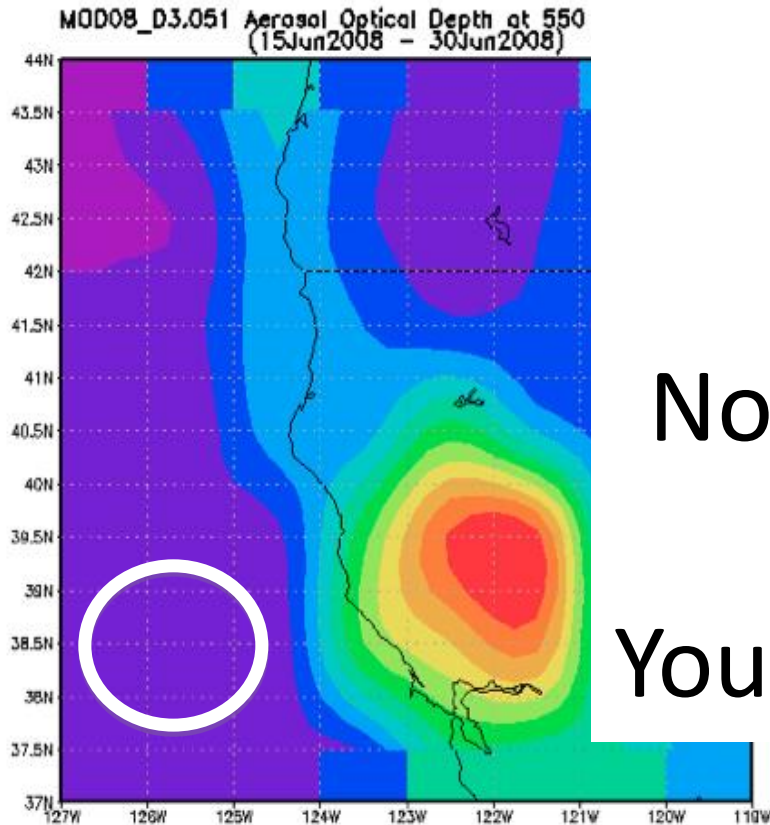
Aqua

Daily Overpass ~ 1:30 PM local time

# A Potential Discovery!

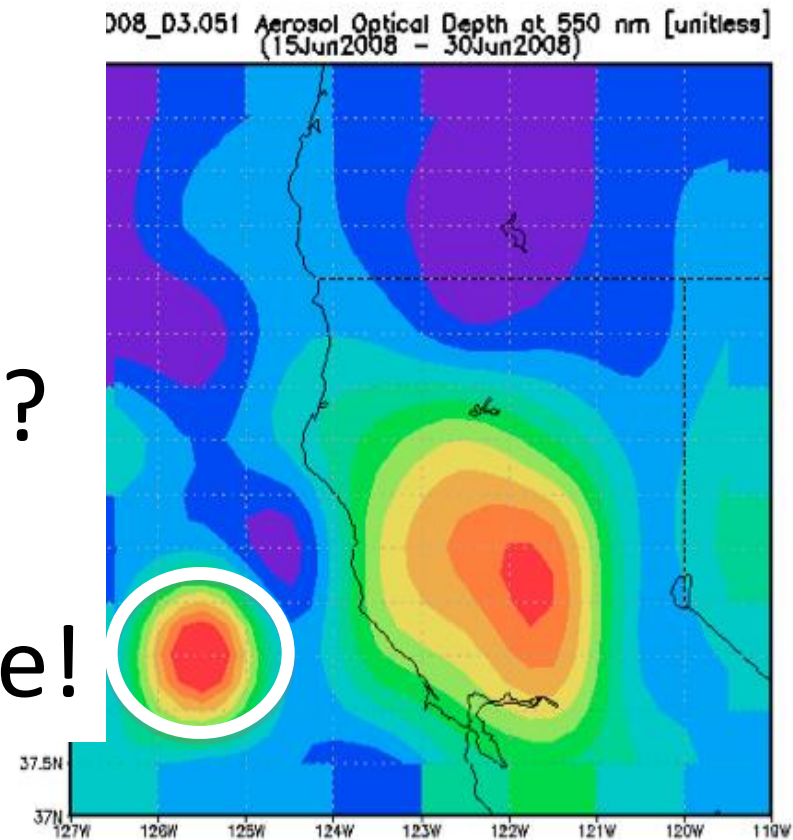
Real  
or  
Not Real ?

You Decide!



Terra

Daily Overpass ~ 10:30 AM local time



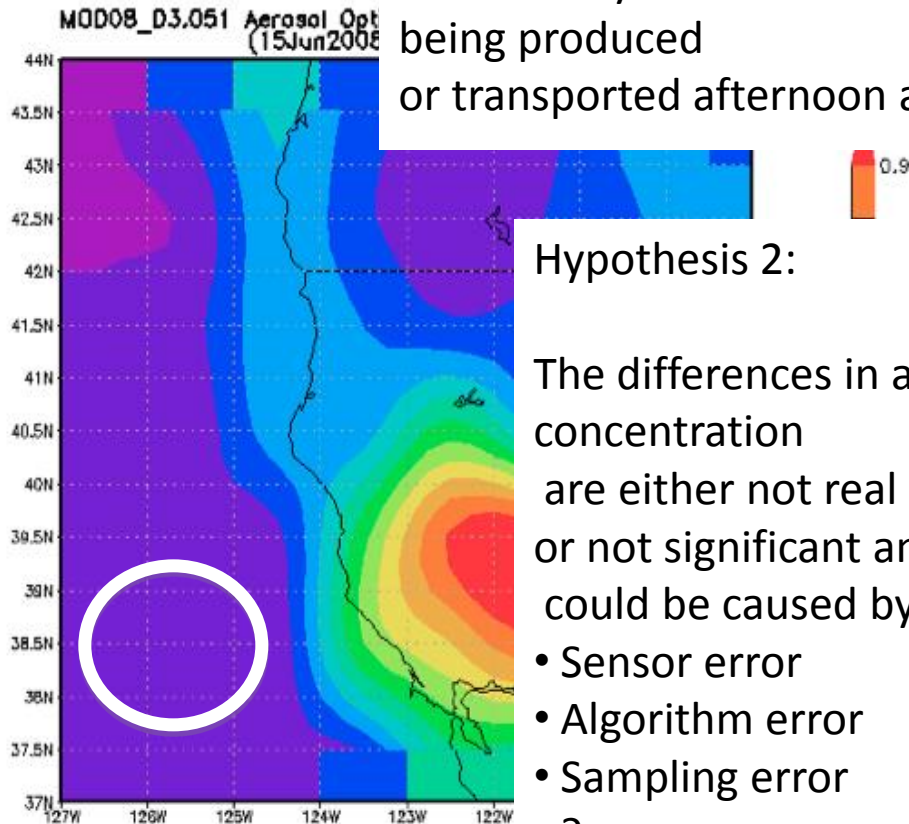
Aqua

Daily Overpass ~ 1:30 PM local time

# AOD at 550 nm Area Average Plot

## Hypothesis 1:

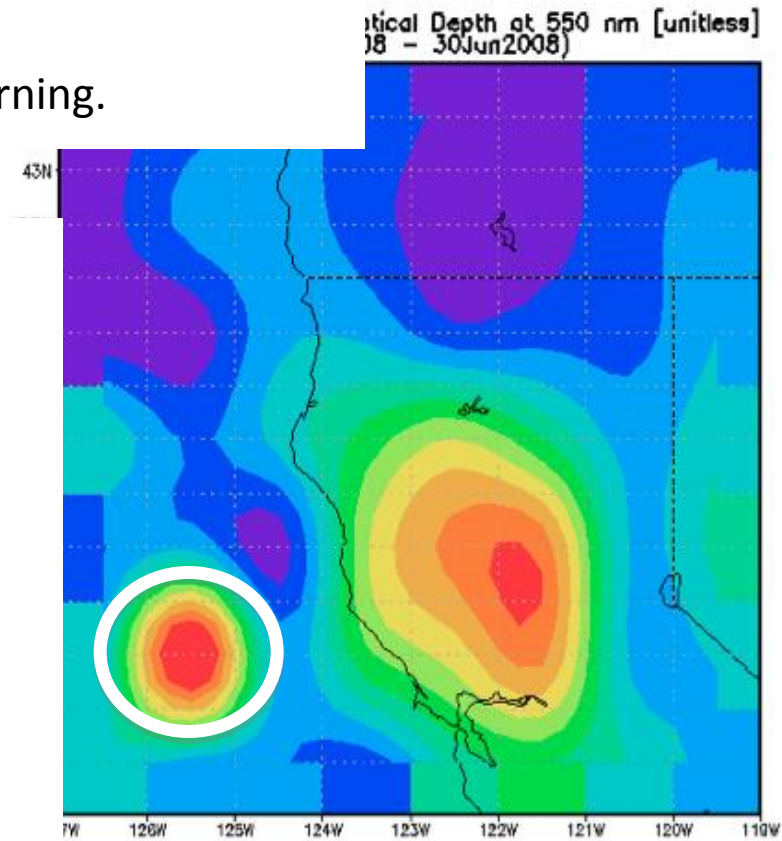
The differences in aerosol concentration represent a Diurnal Cycle with different amounts of aerosol being produced or transported afternoon and morning.



## Hypothesis 2:

The differences in aerosol concentration are either not real or not significant and could be caused by

- Sensor error
- Algorithm error
- Sampling error
- ?



# Possible ways to interpret these differences

- Real world differences
  - Leads to a conclusion(s) about aerosols
  - Can lead to further research about aerosols
- Differences due to other factors
  - Can lead to false conclusion about aerosols
  - Need to be explored and understood to avoid similar problems in the future
  - Can lead to advances in remote sensing capabilities!

# Important Factors to Understand

## Analysis Tool

Giovanni - provides data in 1 degree resolution

## Data Products-

Aqua and Terra Level 2 Products are from a single overpass 10 KM resolution

Aqua and Terra Level 3 Products are global composites in 1 Degree resolution

## Important Factors to Understand

Mid - latitude  $1^\circ \times 1^\circ$  is about 85 Km x 110 Km



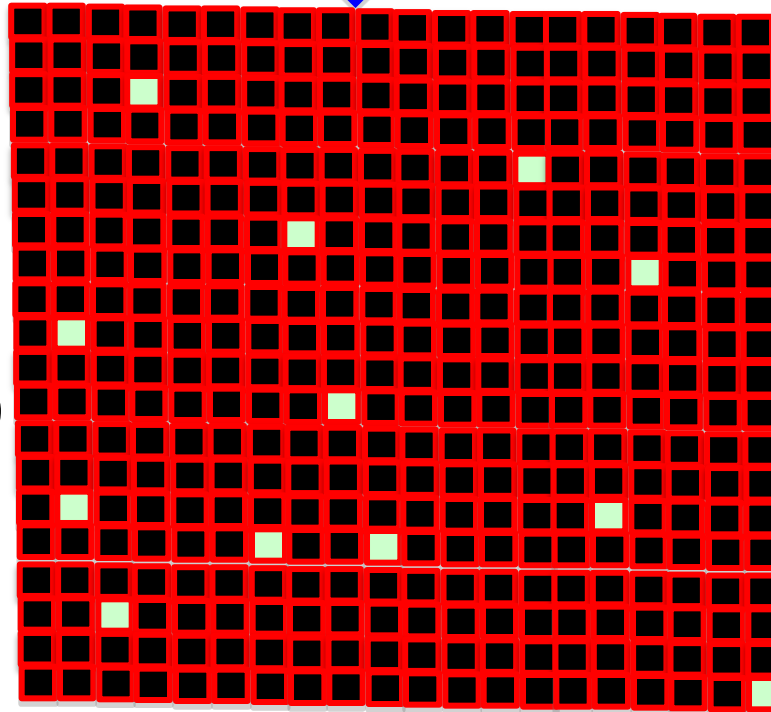
Swath  
Nadir  
Edge

~ 45 10 Km MODIS  
retrievals possible



~ 90 10 Km MODIS retrievals  
possible

# Important Factors to Understand One MODIS 10 Km Retrieval



Begins life as  
**400**  
.5 km (at nadir)  
pixels

And ends as  
a product  
composed of  
**12 - 120** pixels

# Information Necessary to Understand the Results

## Data Products-

Aqua and Terra Level 2 Products are in 10 KM resolution

Aqua and Terra Level 3 Products are in 1 Degree resolution

Giovanni provides Level 3 Data in 1 Degree resolution.

## Sensor Characteristics -

Aqua and Terra are identical designs

There are some small differences in sensor performance

## Algorithm Details-

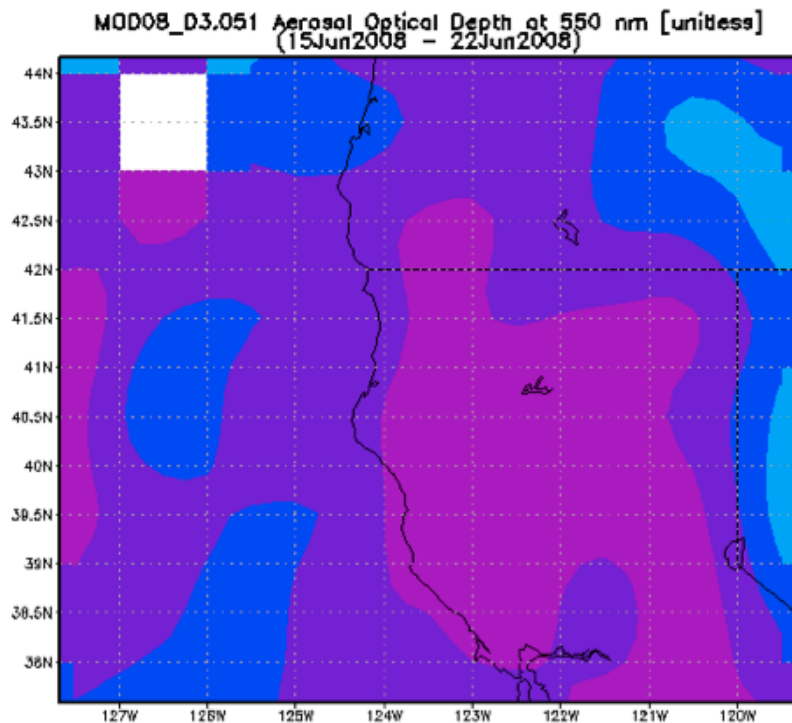
Aqua and Terra use the same algorithm.

# AOD at 550 nm Area Average Plot

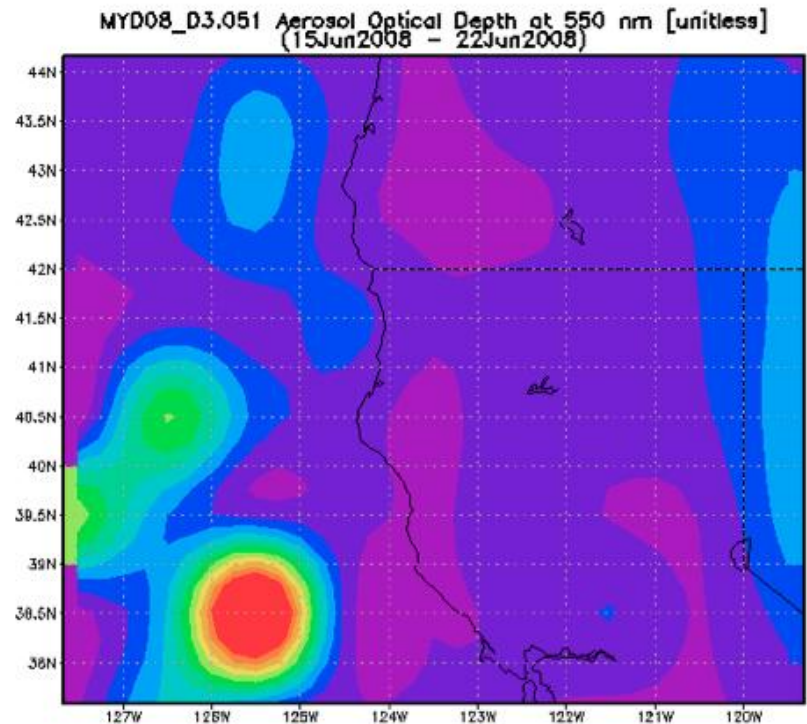
## June 15 - 22, 2008

Examining other features in this data set and using our knowledge of the sensor and products can help us to understand the cause of the differences in mean aerosol.

A blank (white) square has no retrievals for the entire time period.



Terra



Aqua

# Evaluating Data

- Understand the sensor characteristics
- Understand the product details
- Understand the data visualization tools and outputs.

Giovanni helps us turn indiscriminate consumers of satellite data products into connoisseurs

